

Appeal Brief
10/064,451

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES**

In re patent application of:
Johnson et al.

Atty. Docket No.: BUR920010219US1

Serial No.: 10/064,451

Group Art Unit: 1763

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Examiner: Kackar, Ram N.

For: SUSCEPTOR POCKET WITH BEVELED PROJECTION SIDEWALL

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APPELLANTS' REPLY BRIEF

Sirs:

This Appellants' Reply Brief is in response to the Examiner's Answer dated January 24, 2007 (any reference to the "Examiner's Answer" herein refers to the Examiner's Answer of January 24, 2007 unless specifically indicated otherwise), which was in response to the Appellants' Appeal Brief of November 7, 2006, which was in responses to the Notice of Non-Compliant Appeal Brief dated October 30, 2006 setting a one-month period for response, which was in response to the Appellants' Supplemental Appeal Briefs of September 1, 2006 and June 24, 2005. The Appeal Brief of November 7, 2006 was a supplement to the Appellants' Appeal Brief filed March 31, 2005, which was to appeal the final rejection of claims 1-7, 9-15, and 17-18 in the final Office Action dated November 30, 2004. This Reply Brief is therefore timely filed.

I. REAL PARTY IN INTEREST

The real party in interest is International Business Machines Corp., Armonk, New York, assignee of 100% interest of the above-referenced patent application.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-7, 9-15, and 17-18 are all the claims pending in the application and are set forth fully in the attached appendix. Claims 1-18 were originally filed in the application. Appellants filed an Amendent under 37 C.F.R. §1.111 on April 8, 2004 amending the claims. Appellants filed an Amendent under 37 C.F.R. §1.111 on May 27, 2004 further amending the claims. Appellants filed an Amendent under 37 C.F.R. §1.116 on July 28, 2004 further amending the claims and cancelling claims 8, and 16. Appellants filed an Amendent under 37 C.F.R. §1.111 on October 22, 2004 further amending the claims and cancelling claims 8, and 16 and adding claim 19. Appellants filed an Amendent under 37 C.F.R. §1.116 on January 31, 2005 cancelling claim 19. An Advisory Action was issued on February 18, 2005 indicating that the Amendment filed on January 31, 2005 would be entered for purposes of Appeal, but that the rejections to the claims would be sustained. A Notice of Appeal was filed on February 24, 2005, and an Appeal Brief was timely filed on March 31, 2005, which was to appeal the final rejection of claims 1-7,

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9-15, and 17-18 in the final Office Action dated November 30, 2004. A non-final Office Action was issued May 25, 2005 to reopen prosecution in the application. Appellants' have requested reinstatement of the Appeal. The objection to claim 17 indicated in the Examiner's Answer is addressed in Section VII(A) below. The claims shown in the appendix are shown in their amended form as of the January 31, 2005 amendment.

The Examiner's Answer states that "any reference to claim 19 in the appeal brief should be ignored." However, the only reference to claim 19 in the Appellants' Appeal Brief of November 7, 2006 was in relation to the Examiner's rejection as provided in the final Office Action of November 30, 2004 and the Office Action of May 25, 2005, which repeatedly made reference to rejecting claim 19 even though it was cancelled.

Claims 1-7, 9-15, and 17-18 stand rejected under 35 U.S.C. §112, first paragraph. Claims 1-7, 9-15 and 17-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Honma, et al. (U.S. Patent No. 6,596,086), hereinafter referred to as "Honma", in view of Hoshina, et al. (U.S. Patent No. 5,785,764), hereinafter referred to as "Hoshina". Claims 1-7, 9-15 and 17-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Zhao, et al. (U.S. Patent No. 5,968,379), hereinafter referred to as "Zhao", in view of Hoshina.

IV. STATEMENT OF AMENDMENTS

An after-final Office Action (also referred to herein as the "final Office Action") dated November 30, 2004 stated that claims 1-7, 9-15, and 17-19 were rejected. Appellants filed an Amendment under 37 C.F.R. §1.116 on January 31, 2005 cancelling claim 19. An Advisory Action was issued on February 18, 2005 entering the January 31, 2005 Amendment for purposes

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of appeal. After the Appellants filed their initial Notice of Appeal and subsequent Appeal Brief, a non-final Office Action was issued May 25, 2005 to reopen prosecution in the application. Appellants' have requested reinstatement of the Appeal.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The Examiner's Answer contradictorily states that "[t]he summary of claimed subject matter contained in the brief is deficient as below: The summary of claimed subject matter contained in the brief is correct." Accordingly, the Appellants assume that the first part of the sentence in the Examiner's Answer was a typographical error, and as such, the Appellants are assuming that the summary of the claimed subject matter as provided in the Appeal Brief of November 7, 2006 was correct. Nonetheless, the Appellants are reiterating that summary herewith for clarity.

The Appellants' claimed invention is described in pages 3-6 (paragraphs [0011] through [0024]) of the specification and shown in Figures 1 through 3 of the application as originally filed. Please note that the lines numbers indicated below reflect the line numbers corresponding to the lines in the respective paragraph numbers in the specification. The Appellants previously included with their Appeal Brief of November 7, 2006 a copy of the specification, claims, abstract, and drawings as originally filed in accordance with the suggestion by the Examiner during a telephone conference between the Examiner and the undersigned attorney on November 6, 2006. More specifically, with respect to the claimed subject matter:

Claim 1: An apparatus 100 for holding a substrate 120 (lines 1-2 of paragraph [0018])

(page 4) of the specification and FIG. 1), wherein the apparatus 120 comprises a pocket 125 adapted to hold the substrate 120 (lines 3-5 of paragraph [0018] (page 4) of the specification and FIG. 1), wherein the pocket 125 comprises an inner edge 110 (lines 3-5 of paragraph [0018] (page 4) of the specification and a lower surface (shown as an unnumbered structure in FIG. 2; the lower surface of the pocket 125 constitutes the surface where the substrate 120 rests on); a plurality of projections 115 extending radially inward from the inner edge 110 (lines 5-6 of paragraph [0018] (page 4) of the specification); an opening 210 in the lower surface (lines 3-4 of paragraph [0020] (page 5) of the specification and FIG. 2); and a pin 215 disposed in the opening 210 (lines 3-4 of paragraph [0020] (page 5) of the specification and FIG. 2), the pin 215 being configured for lifting the substrate 120 from the pocket 125 (lines 3-4 of paragraph [0020] (page 5) of the specification and FIG. 2); wherein the projections 115 have a beveled edge (line 1 of paragraph [0021] (page 5) through line 7 of paragraph [0022] (page 6) of the specification and FIGS. 2-3), such that an acute angle 201 greater than 80 degrees occurs between the lower surface and the beveled edge (lines 1-8 of paragraph [0021] (pages 5-6) of the specification and FIG. 3), and wherein the projections 115 reduce an area of contact between the inner edge 110 and the substrate 120 (lines 1-11 of paragraph [0020] (pages 5-6) of the specification).

Claim 2: The apparatus 100 comprises a susceptor for holding the substrate 120 (lines 1-2 of paragraph [0018] (page 4) of the specification).

Claim 3: The projections 115 have a “C” shape (lines 8-10 of paragraph [0018] (page 4) of the specification and FIG. 1).

Claim 4: The projections 115 maintain a gap between a sidewall of the substrate 120 and the inner edge 110 (lines 4-6 of paragraph [0020] (page 5) of the specification and FIGS. 2 and 3).

Claim 5: The acute angle 201 comprises an angle not greater than 85 degrees (lines 5-8 of paragraph [0021] (pages 5-6) of the specification).

Claim 6: The projections 115 prevent the substrate 120 from moving within the pocket 125 (line 7 of paragraph [0022] (page 6) of the specification).

Claim 7: An apparatus 100 for holding a substrate 120 (lines 1-2 of paragraph [0018] (page 4) of the specification and FIG. 1), the apparatus 100 comprising a pocket 125 adapted to hold the substrate 120 (lines 3-5 of paragraph [0018] (page 4) of the specification and FIG. 1), wherein the pocket 125 comprises an inner edge 110 (lines 3-5 of paragraph [0018] (page 4) of the specification and a lower surface (shown as an unnumbered structure in FIG. 2; the lower surface of the pocket 125 constitutes the surface where the substrate 120 rests on); a plurality of projections 115 extending radially inward from the inner edge 110 (lines 5-6 of paragraph [0018] (page 4) of the specification); and an opening 210 in the lower surface (lines 3-4 of paragraph [0020] (page 5) of the specification and FIG. 2); wherein the projections 115 have a beveled edge (line 1 of paragraph [0021] (page 5) through line 7 of paragraph [0022] (page 6) of the specification and FIGS. 2-3), and wherein an acute angle 201 greater than 80 degrees occurs

between the lower surface and the beveled edge (lines 1-8 of paragraph [0021] (pages 5-6) of the specification and FIG. 3).

Claim 9: The projections 115 reduce an area of contact between the inner edge 110 and the substrate 120 (line 1 of paragraph [0020] (page 5) through line 11 of paragraph [0021] (page 6) of the specification).

Claim 10: The apparatus comprises a susceptor for holding the substrate 120 (lines 1-2 of paragraph [0018] (page 4) of the specification).

Claim 11: The projections 115 have a “C” shape (lines 8-10 of paragraph [0018] (page 4) of the specification and FIG. 1).

Claim 12: The projections 115 maintain a gap between a sidewall of the substrate 120 and the inner edge 110 (lines 4-6 of paragraph [0020] (page 5) of the specification and FIGS. 2 and 3).

Claim 13: The acute angle 201 comprises an angle not greater than 85 degrees (lines 5-8 of paragraph [0021] (pages 5-6) of the specification).

Claim 14: The projections 115 prevent the substrate 120 from moving within the pocket 125 (line 7 of paragraph [0022] (page 6) of the specification).

Claim 15: A susceptor 100 for holding a wafer 120 (lines 1-2 of paragraph [0018] (page 4) of the specification and FIG. 1), the susceptor 100 comprising a pocket 125 adapted to hold the wafer 120 (lines 3-5 of paragraph [0018] (page 4) of the specification and FIG. 1), wherein the pocket 125 comprises an inner edge 110 (lines 3-5 of paragraph [0018] (page 4) of the specification and a lower surface (shown as an unnumbered structure in FIG. 2; the lower surface of the pocket 125 constitutes the surface where the substrate 120 rests on); a plurality of projections 115 extending radially inward from the inner edge 110 (lines 5-6 of paragraph [0018] (page 4) of the specification); and a device 215 positioned below the pocket 125 (lines 3-4 of paragraph [0020] (page 5) of the specification and FIG. 2), the device 215 being configured for lifting the wafer 120 from the pocket 125 (lines 3-4 of paragraph [0020] (page 5) of the specification and FIG. 2); wherein the projections 115 have a beveled edge (line 1 of paragraph [0021] (page 5) through line 7 of paragraph [0022] (page 6) of the specification and FIGS. 2-3), and wherein an acute angle 201 greater than 80 degrees occurs between the lower surface and the beveled edge (lines 1-8 of paragraph [0021] (pages 5-6) of the specification and FIG. 3).

Claim 17: The acute angle 201 is not greater than 85 degrees (lines 5-8 of paragraph [0021] (pages 5-6) of the specification).

Claim 18: The projections 115 have a “C” shape (lines 8-10 of paragraph [0018] (page 4) of the specification and FIG. 1).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented for review by the Board of Patents Appeals and Interferences are whether claims 1-7, 9-15, and 17-18 fail to comply with the written description requirement under 35 U.S.C. §112, first paragraph, and whether claims 1-7, 9-15, and 17-18 are unpatentable under 35 U.S.C. §103(a) as being unpatentable over Honma in view of Hoshina, and whether claims 1-7, 9-15 and 17-18, are unpatentable under 35 U.S.C. §103(a) as being unpatentable over Zhao in view of Hoshina.

Claims 1-7, 9-15, and 17-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. According to the final Office Action of May 25, 2005 (and sustained by the Examiner's Answer), the claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

Claims 1-7, 9-15 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Honma in view of Hoshina. According to the final Office Action (and sustained by the Examiner's Answer), Honma discloses a susceptor having a pocket to hold substrate having an inner edge and a lower surface (Fig. 1, element 5a) and opening in lower surface for lift pins to lift the substrate (element 5b). The final Office Action (and the Examiner's Answer) admits that Honma does not disclose plurality of beveled edge projections extending radially inward from the inner edge. However, the final Office Action (and the Examiner's Answer) suggests that Hoshina discloses a susceptor with a pocket to hold a substrate, and a plurality of C shaped projections (Fig. 5A, element 17) extending radially inwards at an acute angle of 80 degrees

(complementary 10 degrees) with respect to bottom of pocket (Col. 3 lines 10-43 and Col. 7 lines 5-15). Inherently, according to the final Office Action (and the Examiner's Answer), these projections maintain a gap below the projection and restrict the movement of the standard substrate with a straight edge.

The final Office Action (and the Examiner's Answer) concludes that it would have been obvious for one of ordinary skill in the art at the time of invention to have a plurality of projection in order to hold substrate in position with a very small area of contact. Regarding the limitation of the angle being even slightly greater than 80 degrees, the final Office Action (and Examiner's Answer) states that "it should be understood that slight variability of angle would be obvious in view of experimental optimization and difficulty of maintaining close tolerance."

Claims 1-7, 9-15 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Hoshina. According to the final Office Action (and Examiner's Answer), Zhao discloses a susceptor having a pocket to hold substrate having an inner edge and a lower surface (Fig. 2, element 34) and opening in lower surface for lift pins to lift the substrate (Col. 11 line 1-18 and Col. 19 lines 1-8). The final Office Action (and Examiner's Answer) admits that Zhao does not disclose plurality of beveled edge projections extending radially inward from the inner edge. However, the final Office Action (and Examiner's Answer) suggests that Hoshina discloses a susceptor with a pocket to hold a substrate, and a plurality of C shaped projections (Fig. 5A, element 17) extending radially inwards at an acute angle of 80 degrees (complementary 10 degrees) with respect to bottom of pocket (Col. 3 lines 10-43 and Col. 7 lines 5-15). Inherently, according to the final Office Action (and Examiner's Answer), these projections maintain a gap below the projection and restrict the movement of the standard substrate with a

straight edge. The final Office Action (and Examiner's Answer) concludes that it would have been obvious for one of ordinary skill in the art at the time of invention to have a plurality of projection in order to hold substrate in position with a very small area of contact.

VII. ARGUMENT

A. The Objection to Claim 17

Claim 17 is objected to because of informalities as being dependent on cancelled claim 16. The Examiner's Answer correctly assumes dependency of claim 17 upon claim 15, albeit the Examiner's Answer mischaracterizes this by stating "[f]or this office action claim 17 is assumed to depend upon claim 15." Appellants note that currently there is no Office Action that is outstanding given the Appellants' Request for Reinstatement of the Appeal on June 24, 2005. Furthermore, this objection was never made or otherwise brought to the Appellants' attention in an Office Action contrary to the assertion in the Examiner's Answer. In fact, the first time this objection was addressed was in the Examiner's Answer of February 14, 2006. MPEP §1207.04 indicates that an appellant must reply to a new ground of *rejection* in an Examiner's Answer to avoid having the appeal dismissed or having the claim(s) subject to the rejection cancelled. However, in the present situation, claim 17 is not being *rejected*, rather it is being *objected to*. Therefore, the provisions governing the Appellants' response is not governed by MPEP §1207.04. In fact, MPEP §706.01 indicates that the Board of Patent Appeals and Interferences will not adjudicate matters pertaining to objections, and that such matters should not be combined in appeals to the Board. Therefore, the Appellants contend that the objection should not have been addressed in the Examiner's Answer and put before the Board because the

Appellants are not permitted to redress this issue with the Board. In fact, MPEP §1302.04 suggests that the Examiner should issue an Examiner's Amendment changing the dependency of claim 17 to claim 15 in the interest of expediting prosecution and reducing cycle time. Accordingly, the Appellants formally request that claim 17 be amended via Examiner's Amendment to change its dependency to claim 15 and that this objection be removed.

B. The Rejections Based on 35 U.S.C. §112, First Paragraph

Contrary to the assertions in the Examiner's Answer, the Appellants' specification does provide those skilled in the art with a sufficient written description in order to reasonably convey that the inventors, at the time the application was filed, had possession of the claimed invention.

Paragraph [0021] of the specification, as originally filed, clearly states:

Figure 2 also illustrates angles 200, 201 that formed by the beveled side wall of the projection 115. The region 205 is shown in magnified form in Figure 3. The angle 200 is generally between 5 and 10 degrees, although the invention is not limited to this specific range of angles, but is applicable to all ranges of appropriate angles, depending upon the specific application being addressed. Therefore, the angle 201 comprises an acute angle. Thus, the angle between the bottom of the pocket 125 and the linear inclined surface of the projection 115 is less than 90 degrees (e.g., 80-85 degrees).

Contrary to the erroneous conclusion reached in the Examiner's Answer, there is clear disclosure in the Appellants' specification, as originally filed, of an acute angle greater than 80 degrees. Furthermore, the numeric ranges and other numeric examples given in paragraph [0021] of the specification were never amended by the Appellants during the prosecution of the application. In other words, the above-quoted language of the Appellants' specification is

exactly as it appeared when originally filed.

Unfortunately, there appears to be a misunderstanding of basic mathematical principles. Basic mathematical rules provide that the phrase “greater than” means non inclusive of the lower numerical range. In the Appellants’ case, “greater than” means greater (but not equal) to 80 degrees. Similarly, an acute angle not greater than 85 degrees means less than or equal to 85 degrees according to basic mathematical concepts. Apparently, the position taken in the Examiner’s Answer, for which the rejection is being based upon, is contrary to the Appellants’ interpretation of basic mathematical concepts.

The Federal Circuit has adjudicated similar issues in the Appellants’ favor. For example, the Federal Circuit has indicated in Martin v. Mayer, 823 F.2d 500, 505 (Fed. Cir. 1987) that “[i]t is not required that the application describe the claim limitations in greater detail than the invention warrants. The description must be sufficiently clear that persons of skill in the art will recognize that the applicant made the invention having those limitations” (*citing In re Wertheim*, 541 F.2d 257, 262, 191 USPQ 90, 96 (CCPA 1976)). It appears the Examiner is requiring that the Appellants’ specification describe the Appellants’ claim limitations in greater detail than is required by the Federal Circuit because, as indicated above, the Appellants have specifically provided an appropriate range for its acute angle in its specification, and those skilled in the art could easily understand that the Appellants had possession of their invention based on the disclosed range because the range that is disclosed is clear and does not contradict any other ranges or numeric limitations or any other limitations described in the Appellants’ specification.

Additionally, the Manual of Patent Examining Procedure also suggests finding in favor of the Appellants in this regard. In citing In re Wertheim, 541 F.2d 257, MPEP §2163.05(III)

indicates that the original specification included a range of “25%-60%” and specific examples of “36%” and “50%.” The CCPA in that matter held that claim limitations reciting “between 35% and 60%” did meet the description requirement of 35 U.S.C. §112, First Paragraph. Extending this analysis to the present case, the Appellants have disclosed an acute angle of “less than 90 degrees (e.g., 80-85 degrees)” and have claimed “an acute angle greater than 80 degrees.” By analogy to In re Wertheim, 541 F.2d 257, the Appellants have provided an acute angle (referred to herein as “ x ”) in a range of $0^\circ < x < 90^\circ$ (i.e., an acute angle by definition is any angle between, but not including, 0 degrees and 90 degrees). Moreover, the Appellants have provided specific examples of 80-85 degrees. Accordingly, claim limitations of $80^\circ < x < 90^\circ$ (which is a mathematical equivalence to “an acute angle greater than 80 degrees) meets the description requirement of 35 U.S.C. §112, First Paragraph as promulgated by In re Wertheim, 541 F.2d 257. In other words, the Appellants’ claims do not extend beyond the range described in the Appellants’ specification or provide an open ended range, but rather, as in In re Wertheim, 541 F.2d 257, the claims provide a specific narrow range within the range described in the specification. Accordingly, the Appellants’ claims indeed comply with the written description requirement of 35 U.S.C. §112, First Paragraph.

The Examiner’s Answer indicates that the Appellants’ “specification does not discuss the acute angle to be greater than 80° [sic] at the exclusion of an angle of exactly 80° . This is important in view of absence of any disclosed inventive advantage accruing from an angle greater than 80° , which would not accrue from an angle exactly 80°]....Clearly, there is no disclosure and appreciation of any unexpected advantage of an angle greater than 80°] but not exactly 80°].” Lost in this criticism is the fact that the written description requirement of 35

U.S.C. §112, First Paragraph imposes no such obligations on the Appellants. Accordingly, this criticism in the Examiner's Answer is moot and should otherwise be ignored by the Board as having no relevance to the current rejection of claims 1-7, 9-15, and 17-18 under 35 U.S.C. §112, First Paragraph.

Therefore, Appellants strongly contend that the position taken in the Examiner's Answer is erroneous, and that claims 1-7, 9-15, and 17-18 absolutely comply with the written description requirement of 35 U.S.C. §112, First Paragraph, and that the claims contain subject matter which was described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 1-7, 9-15, and 17-18.

C. The Prior Art Rejections Based on 35 U.S.C. §103(a)

1. The Prior Art

(a) The Honma Reference

Honma teaches in an apparatus for vapor phase growth of silicon single crystal thin films, in-plane uniformity of susceptor temperature is improved and film thickness of a silicon single crystal thin film is uniformized. The base material of a lift pin 8 provided in a pocket 5a of a susceptor 5 is changed to a base material lower in thermal conductivity than a base material of the susceptor 5, by which local decreases in susceptor temperature in the vicinity of the lift pin are prevented. As the base material of the lift pin 8, SiC, carbon of a desired grade and quartz are preferred.

(b) The Hoshina Reference

Hoshina teaches a susceptor 1 for a gas phase growth apparatus to which a round depressed pocket 2 with a bottom a side wall is formed for the placing of a semiconductor wafer 3 wherein a protuberance 6 is provided on the circumference of the pocket at and near the position where the semiconductor wafer touches the side wall 4 of the pocket 2 in such a way that the protuberance 6 covers a part of a chamfered area of the semiconductor wafer 3 without touching it. Thus, cracks and breakage due to adhesion between a susceptor and a wafer may be prevented.

(c) The Zhao Reference

Zhao teaches systems, methods, and an apparatus for depositing titanium films at rates up to 200 Å/minute on semiconductor substrates from a titanium tetrachloride source. A ceramic heater assembly with an integrated RF plane for bottom powered RF capability allows PECVD deposition at a temperature of at least 400°C for more efficient plasma treatment. A thermal choke isolates the heater from its support shaft, reducing the thermal gradient across the heater to reduce the risk of breakage and improving temperature uniformity of the heater. A deposition system incorporates a flow restrictor ring and other features that allow a 15 liters/minute flow rate through the chamber with minimal backside deposition and minimized deposition on the bottom of the chamber, thereby reducing the frequency of chamber cleanings, and reducing clean time and seasoning. Zhao also teaches deposition and cleaning processes.

2. Appellants' Position

(a) Independent Claims 1, 7, and 15

(i) The Rejection Based on Honma in view of Hoshina

Appellants respectfully traverse the rejections in the final Office Action of November 20, 2004 and further sustained in the Examiner's Answer of January 24, 2007 of independent claims 1, 7, and 15 based on the following discussion. Pages 6-7 of the Examiner's Answer refers to MPEP §2144.05 as establishing a case of prima facie obviousness of the Appellants' claimed "acute angle greater than 80 degrees." However, the facts cited in the case referred to in MPEP §2144.05, Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985), are different than the present situation. In the Titanium Metals situation, the prior art reference did not specifically provide a teaching that an alloy concentration percentage falling outside the cited range would be undesirable, unworkable, or otherwise contrary to the goals and/or objectives of the cited method and/or composition.

Conversely, in the present situation, Hoshina specifically states if the "angle θ_1 is larger than 80 degrees, then, when forming a thick thin film, the amount of the source material gas which flows around to the contact area between the wafer 3 and the side wall 4 of the pocket 2 and its vicinity increases and cross bridges grow due to the deposition of silicon, resulting in adhesion which causes cracks or breakage when taking out the wafer 3 from the pocket 2 after the gas phase growth." (See Column 5, lines 20-32 of Hoshina). The Examiner's Answer dismisses this very important aspect of Hoshina's teaching as being only relevant to thick film deposition. Unfortunately, this is a mischaracterization of Hoshina's entire teaching. First, Column 5, lines 20-32 of Hoshina is directed to "thick thin film" deposition not "thick film"

deposition. This is significant because the Examiner's Answer attempts to create the impression that Hoshina's specific warning of not practicing its design with an angle greater than 80 degrees is merely limited to a situation that is a special case (i.e., thick film) that is outside the scope of the rest of its teaching. However, Hoshina's entire patent (teaching) is directed to "thick thin film" formation (see Column 1, lines 15-18 of Hoshina, which states, "[m]ore particularly, [the invention] relates to the structure of the pocket by which cracks, breakage and adhesion can be prevented while forming a thick single crystal thin film on the semiconductor wafer." Thus, column 5, lines 20-32 of Hoshina is not a special case as the Examiner's Answer seemingly posits, but rather is directly related to the central focus of Hoshina's invention (i.e., a thick thin film). Therefore, by Hoshina specifically teaching that it would be disadvantageous to utilize an angle greater than 80 degrees for the reasons specifically addressed in Hoshina, and described above, one of ordinary skill in the art would never be motivated to alter Hoshina's invention to include an angle greater than 80 degrees for fear of causing cracks or breakage when taking out the wafer from the pocket after the gas phase growth.

Accordingly, Hoshina's invention cannot operate effectively when the angle θ_1 is larger than 80 degrees and improve film uniformity without errors. Contrary to this, Appellants' invention is indeed workable without errors when the angle is greater than 80 degrees. Therefore, Appellants' invention is not obvious, and one of ordinary skill in the art would not attempt to increase the angle θ_1 to be larger than 80 degrees as suggested in the final Office Action (and sustained in the Examiner's Answer) because Hoshina, as indicated above, suggests his invention would be unworkable if an angle of greater than 80 degrees was used. Thus Hoshina does not teach or suggest including the features "the projections have a beveled edge,

such that an acute angle greater than 80 degrees occurs between the lower surface and the beveled edge.”

Furthermore, regarding independent claims 1, 7, and 15, first, the references, separately, or in combination, fail to disclose, teach or suggest a reason or motivation for being combined. Second, even assuming that the references would have been legally combinable, Honma does not teach or suggest the features of independent claim 1, and similarly independent claims 7 and 15, including the projections have a beveled edge, such that an acute angle greater than 80 degrees occurs between the lower surface and the beveled edge.

Indeed, the final Office Action (and Examiner’s Answer) admits that Honma “do[es] not disclose [a] plurality of beveled edge projections extending radially inward from the inner edge,” and thus, Honma is deficient in failing to disclose the above feature of Appellants’ claimed invention. (See final Office Action, Page 2, Section 2). Hoshina is also deficient.

In contrast, Figures 1A, 1B, 2, and 5A of Hoshina merely disclose a susceptor 1 for a gas phase growth apparatus to which a round depressed pocket 2 with a bottom a side wall is formed for the placing of a semiconductor wafer 3 where a protuberance 6 is provided on the circumference of the pocket at and near the position where the semiconductor wafer touches the side wall 4 of the pocket 2 and a back side of the wafer touches the bottom 5 of the pocket 2 so that an angle θ_1 is formed between a side 6a of the protuberance facing the bottom 5 of the pocket 2 and the bottom 5 of the pocket is set to be an acute angle.” Contrary to the assertion in the final Office Action (and sustained in the Examiner’s Answer), the acute angle in Hoshina is in a “range of 40-80 degrees, preferably in a range of 60-75 degrees,” and is not greater than 80 degrees between a lower surface and a beveled edge as claimed by Appellants. (See Hoshina at

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Abstract; Column 3, lines 10-43; Column 5, lines 1-13; Column 7, lines 5-15; and Figures 1A, 1B, 2 and 5A).

To reiterate, page 2 of the final Office Action (and page 5 of the Examiner's Answer) states that "Hoshina et al disclose a susceptor with a pocket to hold a substrate, [and a] plurality of C shaped projections (Fig 5A-17) extending radially inward[s] at an acute angle of 80 degrees (complementary 10 degrees) with respect to [the] bottom of [the] pocket." Appellants completely agree with this fact. However, this is not what the Appellants' claimed language is directed to. Clearly, the Appellants' claimed language is contrary to this. Again, Appellants' independent claim 1 states, in part, "...wherein said projections have a beveled edge, such that an acute angle greater than 80 degrees occurs between said lower surface and said beveled edge...." Independent claims 7 and 15 state, in part, "...wherein an acute angle greater than 80 degrees occurs between said lower surface and said beveled edge." Clearly, there appears to be a misunderstanding of basic mathematical principles. Appellants contend that a "range of 40-80 degrees" provided in Hoshina does not overlap the claimed "greater than 80 degrees." Basic mathematical rules provide that the phrase "greater than" means non inclusive of the lower numerical range. In the Appellants' case, "greater than" means greater (but not equal) to 80 degrees. In Hoshina, the "range of 40-80 degrees" means at most 80 degrees for the upper bound of the range. Apparently, the position taken in the final Office Action (and sustained in the Examiner's Answer), for which the rejection is being based upon, is contrary to the Appellants' interpretation of basic mathematical concepts. Therefore, Appellants strongly contend that Hoshina cannot and does not teach the claimed invention even if combined with Honma.

Page 4 of the final Office Action states that, “[S]ince Hoshina discloses [an] angle of 80 degrees, it is in [the] overlapping range with the claim of 80-85 degrees.” It is noted that the Examiner’s Answer does not explicitly recant this statement; therefore the Appellants believe this position is being sustained by the Examiner’s Answer. First, none the Appellants’ claims recite a range of 80-85 degrees. Second, for the reasons stated above, the Appellants’ claims are directed at a range of greater than 80 degrees (independent claims 1, 7, and 15) and not greater than 85 degrees (dependent claims 5, 13, and 17). Thus, the position in the final Office Action (and presumably sustained in the Examiner’s Answer) is clearly erroneous as the claimed invention is not in the overlapping range cited in Hoshina.

In other words, Hoshina teaches away from Appellants’ claimed invention. As indicated, if the “angle θ_1 is larger than 80 degrees, then, when forming a thick thin film, the amount of the source material gas which flows around to the contact area between the wafer 3 and the side wall 4 of the pocket 2 and its vicinity increases and cross bridges grow due to the deposition of silicon, resulting in adhesion which causes cracks or breakage when taking out the wafer 3 from the pocket 2 after the gas phase growth.”

The Examiner’s Answer further attempts to discredit the Appellants’ cause by indicating that the Appellants’ “specification has not provided any guidance to assume that an acute angle greater than 80[°] (say 80.1[°]) has different properties than an angle of 80[°]. In the brief the applicant has dwelled greatly on the merits of an angle greater than 80[°] but has not provided any persuasive argument that [a] prima facie case of obviousness does not exist in view of the claimed ranged and prior art ranges being so close.” As further discussed below, the angle configuration (greater than 80 degrees) is quite critical to the Appellants’ claimed invention, and

is not merely a design choice. Furthermore, the prior art itself, Hoshina, specifically provides the guidance as to why an acute angle greater than 80° has different properties than an angle of 80°. Again, see Column 5, lines 20-32 of Hoshina as providing this guidance. In fact, case law establishes that the Appellants have effectively rebutted the Examiner's prima facie case of obviousness as promulgated by In re Malagari, 499 F.2d 1297, 1303, 182 USPQ 549, 553 (C.C.P.A. 1974), which provides that a prima facie case of obviousness can be rebutted if the applicant can show "that the art in any material respect taught away" from the claimed invention. Here, as described above, Hoshina specifically teaches away from the Appellants' claimed invention by admonishing using an angle greater than 80 degrees. Hence, a person of ordinary skill in the art would have been surprised with the Appellants' results indeed given Hoshina's teaching and would have found Appellants' results unexpected in view of Hoshina, which the Federal Circuit has adjudicated as evidencing non-obviousness. See In re Soni, 54 F.3d 746, 750, 34 USPQ 2d 1684, 1687 (Fed. Cir. 1995).

The Examiner's Answer (page 5) further states that "[r]egarding the limitation of the angle being even slightly greater than 80 degrees, it should be understood that slight variability of [the] angle would be obvious in view of experimental optimization and difficulty of maintaining close tolerance." Clearly, this is merely just the Examiner's own personal assertion and no tangible evidence is offered by the Examiner to prove this self-serving conclusion. In fact, those skilled in the art of semiconductor wafer processing would readily appreciate that the manufacturing techniques in this industry are so advanced that seemingly small and slight tolerances can be corrected and adhered to without difficulty. As proof of this one need only view all of the patents issued (or patent applications published) by the USPTO in the field of

semiconductor wafer processing or read articles in journals such as Semiconductor Science Technology to appreciate this fact.

Appellants teach an apparatus for holding a substrate including projections having a beveled edge of a projection 115 where an acute angle 201 greater than 80 degrees occurs between the lower surface of an opening and the beveled edge. Since angle 200 combined with the complimentary acute angle 201 forms a 90 degree angle and, as indicated, “angle 200 is generally between 5 and 10 degrees,” then angle 201 includes an acute angle less than 90 degrees, “e.g., 80-85 degrees.” As a result, the acute angle 201 is greater than 80 degrees between the lower surface and the beveled edge.

The criticality of the Appellants’ acute angle 201 being greater than 80 degrees is that the beveled side of wall of the projection reduces the contact area between the projection 115 and the substrate 102, thereby reducing the possibility that the substrate 120 will stick within the pocket of the apparatus 100. Accordingly, the Appellants’ invention improves film uniformity of the semiconductor wafer undergoing processing while providing small points of contact with the wafer, and thus improving the angle of the contacts to prevent errors. (See Paragraph [0023] of Appellants’ specification).

The Appellants’ claimed invention provides an apparatus/susceptor which is utilized in wafer processing, and in particular in heavy volume wafer processing. As such, manufacturing speed and efficiency are central to use of the Appellants’ claimed invention in heavy volume wafer processing. Thus, the lifting pin provided by the Appellants’ claimed invention aids in speeding the wafer processing as opposed to manual lifting or lifting by an unattached and/or incongruous mechanism. However, the device in Hoshina does not provide lifting pins, and as

such is suggestive of not being incorporated in heavy wafer processing, and while the device in Honma appears to teach lift pins, suggesting use in heavy wafer processing, it would not be logical or obvious to combine Honma with Hoshina because each is directed to a different type of wafer processing scheme (i.e., heavy volume wafer processing vs. non-heavy volume wafer processing). Nonetheless, even if Honma were to be legally combined with Hoshina, they would still fail to teach all of the elements of the claimed invention, particularly that the angle configuration between the lower surface of the pocket and the beveled edge of the projection being greater than 80 degrees.

In non-heavy volume wafer processing, such as Hoshina, the susceptor may be positioned sufficiently level such that it does not move (i.e., through vibrations, etc.). However, in most conventional heavy volume wafer processing susceptors, due to the speed at which these devices operate, vibrational forces tend to shift the susceptor causing it to become non-leveled, which may cause the wafer to slide slightly on one side of the susceptor, which then causes the wafer to be in contact with two beveled retainers. In this case, the angle of the retainers is extremely critical. If the angle is less than 80 degrees, as demonstrated during the loading/unloading tests (when the wafer being lifted from the pocket), scratches result on the edge of the wafer due to excessive contact/friction between wafer and retainers. This creates foreign material generation and can result in wafer failure (i.e., wafer breakage). The final Office Action (and presumably the Examiner's Answer), on page 4, states that "[t]here is no mention of the amount of scratches when the angle is exactly 80 degrees." However, it is irrelevant what the results are at exactly 80 degrees because the claimed language is not directed to exactly 80 degrees, but rather greater than 80 degrees. Therefore, the retainer angle is very critical and must be greater than 80

degrees for the device to function properly. In fact, experimental testing performed on the apparatus/susceptor provided by the Appellants' invention illustrated that all wafer transfers (loading/unloading testing) were friction free (i.e., no scratches or breakage) at angles greater than 80 degrees.

Hoshina clearly states, in col. 3, lines 23-28, col. 5, lines 6-12, and col. 7, lines 10-15 that the angle is in the range of 40-80 degrees, and preferably in the range of 60-75 degrees. However, such a range of angles would be unworkable for the claimed invention to function properly. This is so because using any angle less than 80 degrees would result in severe wafer errors (such as WOOPS errors as described on paragraph [0004] of the Appellants' specification. In fact, empirical data gathered by the Appellants further illustrates this, wherein the data was gathered based on visual inspections of wafer edges after loading and unloading of wafers in a susceptor (as would be used in heavy volume wafer processing). In order to test the results achieved by prior art devices, different angle configurations were tested including angles of 45 and 60 degrees. For 45 degree angles, out of 50 instances of loading/unloading of wafers in a susceptor, the results showed two broken wafers and 33 wafers with edge marks (scratches). At 60 degrees, the results showed one broken wafer and 24 wafers with edge marks (scratches).

Furthermore, page 5 of the final Office Action (and presumably the Examiner's Answer) states that "[t]he specification does not indicate that an angle even slightly greater than 80 has any critical importance." However, case law and the MPEP clearly do not require that the specification specifically state that dimensional limitations are critical (see MPEP §716.02(f)). Thus, it is irrelevant whether the specification does or does not discuss the criticality of the dimensions.

In fact, the criticality of the angle provided by the claimed invention would not obvious to one of ordinary skill in the art, who may be a technician overseeing the wafer processing, given that the prior art, namely Hoshina, provides a preferable range of an angel between 60 and 75 degrees. Thus, one of ordinary skill in the art would have clearly read Hoshina to provide the preferable parameters of a susceptor device, and without undue experimentation, would have used these preferable parameters in constructing a similar device. However, the Appellants determined that using conventional devices still resulted in wafer errors (i.e., WOOPS errors), and determined that the angle between the lower surface of the pocket and the beveled edge of the projection was in fact critical and that this angle had to be greater than 80 degrees to overcome a very challenging problem long sought to be solved in the industry; that of wafer error reduction and elimination, especially in heavy volume wafer processing.

Therefore, Hoshina, as indicated above, only teaches an acute angle in the range of 40-80 degrees, otherwise, an angle greater than 80 degrees will result in adhesion which causes cracks or breakage when taking out the wafer 3 from the pocket. Thus, Appellants traverse the assertion that Hoshina teaches Appellants' invention.

For at least the reasons outlined above, Appellants respectfully submit that neither Honma nor Hoshina, alone or in combination, disclose, teach or suggest, including the projections have a beveled edge, such that an acute angle greater than 80 degrees occurs between the lower surface and the beveled edge as recited in independent claim 1, and similarly independent claims 7 and 15, of Appellants' invention. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 1, 7, and 15.

(ii) The Rejection Based on Zhao in view of Hoshina

Regarding independent claims 1, 7, and 15, first, the references, separately, or in combination, fail to disclose, teach or suggest a reason or motivation for being combined. Second, even assuming that the references would have been combined, Zhao does not teach or suggest the features of independent claim 1, and similarly independent claims 7 and 15, including the projections have a beveled edge, such that an acute angle greater than 80 degrees occurs between the lower surface and the beveled edge.

Indeed, the Examiner's Answer admits that Zhao "do[es] not disclose [a] plurality of beveled edge projections extending radially inward from the inner edge," let alone, the above indicated feature. Accordingly, Zhao is deficient by not disclosing Appellants' claimed invention. Hoshina is also deficient for the reasons indicated in section VII(C)2(a)(i) above.

Hoshina, as indicated in section VII(C)2(a)(i) above, only teaches an acute angle in the range of 40-80 degrees, otherwise, an angle greater than 80 degrees will result in adhesion which causes cracks or breakage when taking out the wafer 3 from the pocket. Thus, Appellants traverse the assertion that Hoshina teaches Appellants' invention.

For at least the reasons provided in section VII(C)2(a)(i) above, Appellants respectfully submit that neither Zhao nor Hoshina, alone or in combination, disclose, teach or suggest, including the projections have a beveled edge, such that an acute angle greater than 80 degrees occurs between the lower surface and the beveled edge as recited in independent claim 1, and similarly independent claims 7 and 15, of Appellants' invention.

In view of the foregoing, the Appellants respectfully submit that the cited prior art references do not teach or suggest the features defined by independent claims 1, 7, and 15 and as

such, claims 1, 7, and 15 are patentable over Honma in combination with Hoshina or Zhao in combination with Hoshina. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 1, 7, and 15.

(b) Dependent claims 2-6, 9-14, and 17-18

Appellants respectfully traverse the rejections in the final Office Action (and sustained in the Examiner's Answer) of dependent claims 2-6, 9-14, and 17-18 based on the following discussion.

(i) Dependent claims 2 and 10

Dependent claims 2 and 10 generally provide, "wherein said apparatus comprises a susceptor for holding said substrate." While Honma, Hoshina, and Zhao teach susceptors holding wafers, they do not do so in the manner provided by Appellants' susceptor, which allows for improved film uniformity on the semiconductor wafer undergoing processing. In fact, the susceptors disclosed in each of Honma, Hoshina, and Zhao do not guarantee good film uniformity for single wafer tools as does the Appellants' susceptor. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 2 and 10.

(ii) Dependent claims 3, 11, and 18

Dependent claims 3, 11, and 18 generally provide, "wherein said projections have a "C" shape." Clearly neither Honma nor Zhao teach "C" shaped projections. Moreover, the protrusions 17 in FIG. 5A of Hoshina are configured on the lower half of the pocket 13 and are

symmetrically placed in relation to the vertical line running through the center of the pocket 13 (Col. 1, lines 55-58 of Hoshina). The configuration of the Appellants' projections are not so limited. Additionally, there is no description in Hoshina as to the actual shape of the protrusions 17. Rather, it appears that the final Office Action (and presumably the Examiner's Answer) is assuming that FIG. 5A discloses "C" shaped protrusions. However, without substantiation in the specification of Hoshina, this conclusion may not necessarily be correct. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 3, 11, and 18.

(iii) Dependent claims 4 and 12

Dependent claims 4 and 12 generally provide, "wherein said projections maintain a gap between a sidewall of said substrate and said inner edge." With regard to this feature of the Appellants' invention, the final Office Action (and presumably the Examiner's Answer) argues inherency; that is, that Hoshina inherently teaches this feature. However, case law establishes that an obviousness rejection is improper if specific claimed features are not taught in the prior art, but are instead rejected on inherency. See generally, In re Spormann, 363 F.2d 444, 448, 150 USPQ 449, 452 (C.C.P.A. 1966). Thus, the obviousness rejections based on inherency for claims 4 and 12 are improper. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 4 and 12.

(iv) Dependent claims 5, 13, and 17

Dependent claims 5, 13, and 17 generally provide, "wherein said acute angle comprises an angle not greater than 85 degrees." Clearly, the acute angle referred to in claims 5, 13, and 17

refer to the the acute angle greater than 80 degrees provided in independent claims 1, 7, and 15. Thus, dependent claims 5, 13, and 17 essentially provide the range of the angle (i.e., greater than 80 degrees but less than 85 degrees). Thus, as previously indicated, neither Honma, Hoshina, nor Zhao teach an angle greater than 80 degrees. Hence, it follows that neither Honma, Hoshina, nor Zhao can teach an angle greater than 80 degrees but less than 85 degrees, as implicitly provided in dependent claims 5, 13, and 17. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 5, 13, and 17.

(v) Dependent claims 6 and 14

Dependent claims 6 and 14 generally provide, “wherein said projections prevent said substrate from moving within said pocket.” With regard to this feature of the Appellants’ invention, the final Office Action (and presumably the Examiner’s Answer) argues inherency; that is, that Hoshina inherently teaches this feature. However, case law establishes that an obviousness rejection is improper if specific claimed features are not taught in the prior art, but are instead rejected on inherency. See generally, In re Spormann, 363 F.2d 444, 448, 150 USPQ 449, 452 (C.C.P.A. 1966). Thus, the obviousness rejections based on inherency for claims 6 and 14 are improper. Therefore, the Board is respectfully requested to reconsider and withdraw the rejections to claims 6 and 14.

(vi) Dependent claim 9

Dependent claim 9 generally provides, “wherein said projections reduce an area of contact between said inner edge and said substrate.” The final Office Action (and presumably

the Examiner's Answer) tends to suggest that Appellants' projections will increase the contact area rather than reducing it (see page 4 of final Office Action (and presumably in the Examiner's Answer)). This suggests a fundamental lack of understanding of the Appellants' invention, and the geometric configurations of Appellants' invention. Appellants' projections 115 prevent the substrate 120 from contacting the remaining portions of the inner wall 110 of the apparatus 100. Therefore, the projections 115 substantially reduce the area of contact between the side wall of the substrate 120 and the inner wall 110. Reducing this area of contact decreases the amount of heat transfer from the inner wall 110 and the side wall of the substrate 120. By decreasing the amount of heat transfer between inner wall 110 and the side wall of the substrate 120, the likelihood of the substrate 120 melting or sticking to the inner wall 110 is substantially reduced or eliminated thereby preventing wafer out of pocket errors. Additionally, the likelihood of a thermal stress developing across the substrate 120 due to the edge of the substrate 120 becoming hotter than the center of the substrate 120 is also substantially reduced or eliminated thereby improving film uniformity. Similarly, the likelihood of a thermal stress developing across the substrate 120 and causing warpage of the substrate 120 is also substantially reduced or eliminated thereby improving film uniformity and preventing wafer out of pocket errors. Thus, the Appellants' projections 115 clearly reduce the area of contact between the inner edge of the pocket and the substrate. Therefore, the Board is respectfully requested to reconsider and withdraw the rejection to claim 9.

D. CONCLUSION

In conclusion, the rejections sustained in the Examiner's Answer are improper pertaining

to the rejections under 35 U.S.C. §112, First Paragraph, and the prior art references of record, either alone or in combination with one another, fail to teach essential elements of the Appellants' claimed invention. In many instances, there appears to be an unnecessarily broad interpretation of the prior art references as indicated in the Examiner's Answer. As indicated above, regardless of how each of the prior art references are interpreted they still fail to teach the Appellants' claimed invention as the prior art references either teach away from the Appellants' claimed invention, are contrary to the Appellants' claimed invention, or all together are bereft of any teaching whatsoever of the elements provided in the Appellants' claimed invention.

In fact, each prior art reference cited by the Examiner is complete and functional in itself, so there is simply no motivation to use parts from or add or substitute parts to any reference to try and teach, but failing nonetheless, the claimed invention. Moreover, because the references take mutually exclusive paths and reach different solutions to a similar problem, they essentially teach away from each other, and thus it would not be logical for one of ordinary skill in the art to combine them. However, even if the references were legally combinable, as indicated above, the references would not teach the claimed invention because several claimed features are lacking in the prior art references. Furthermore, the several rejections based on inherency are demonstrated to be improper because the Examiner has failed to provide documented evidence in support of the precepts taken as inherent.

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In view of the foregoing, Appellants submit that claims 1-7, 9-15, and 17-18, all the claims presently pending in the application, are patently distinct from the prior art of record and are in condition for allowance. The Board is respectfully requested to cancel all of the rejections to the claims and to pass the application to issue. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

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